2021

China's Three Gorges Dam: Development, Displacement, and Degradation

Trent M. Carney

Nebraska Anthropologist , Volume 29: 2021

China's Three Gorges Dam: Development, Displacement, and Degradation

Trent M. Carney
School of Global Integrative Studies, UNL, Lincoln, NE, USA
tcarney@huskers.unl.edu

Abstract: *China's state-led push towards modernization and enhanced economic growth has been marked by environmentally unsustainable practices, the results of which are still being combated today (Sapiro 2001). The construction of the Three Gorges Dam on the Yangtze River in Hubei province, China, represents the largest civil engineering project of the modern era. The dam is capable of generating one-sixth of China's total electrical capacity; however, China's attempts to go green come at a substantial cost. (Gleick 2009; Morgan & Waretini 2013; Paerl et al. 2011; Xu et al. 2013). Some of these consequences include increased geologic activity: the forced resettlement of impacted populations, threats to endangered species and fragile regional ecosystems due to altered river currents, sediment flow rates, and the development of dangerous algae blooms (Gleick 2009; Jackson and Sleigh 2000; Li et al. 2014; New and Xie 2008; Paerl et al. 2011; Park et al. 2003; Tan, 2008; Xu et al. 2013). The process of developing publicly accessible environmental impact statements should be more transparent and democratic with a stronger focus on sustainability. This would necessitate the thorough investigation of local demographics, environmental thresholds, biodiversity, and ecosystem interconnectivity.*

Introduction

The construction of China's Three Gorges Dam represents the accumulation of years of effort by Chinese officials to conquer the river that has been hailed as the cradle of Chinese civilization (Beattie 2002; Jackson & Sleigh 2000; Marks 2012a, 2012b; Murphey 1967; Normile 1997). Despite the symbolism and national prestige that comes as a result of such a massive edifice to human ingenuity, there are signs that this conquest has come at a heavy cost (Beattie 2002; Gleick 2009; Morgan & Waretini 2013; Xu et al. 2013). Moreover, this conquest over nature may not be nearly as complete as officials would have the locals, or the world, believe (Morgan & Waretini 2013; New and Xie 2008; Xu et al. 2013; Zhu et al. 2008). This writing serves to discuss the environmental and social impacts that have occurred throughout the development of the Three Gorges Project, the largest hydraulic project in the history of the world, and the issues that have been experienced in the region since its completion. After thorough elaboration of these issues, suggestions will be made as to how these detrimental impacts may be mitigated, if not at Three Gorges itself, then at future sites.

From its headwaters in the glaciers of the Tibetan Plateau, the Yangtze River flows 6,418 kilometers across the breadth of the Chinese mainland before discharging into the East China Sea (Morgan & Waretini 2013). A dam spanning the Yangtze has been the brainchild of Chinese statesmen, be they capitalist, or communist, for over 100 years (Beattie 2002; Gleick 2009).

However, the Chinese revolution in 1949 brought with it the introduction of communist thought and the Western concept of 'modes of production', of which nature represented the natural productive forces waiting to be tapped by social labor (Marx & Engles 1988). The Chairman of the Chinese Communist Party at the time was Mao Tse Tung. His interpretation of Marxist ideology was that nature could be harnessed and brought under the control of the people in order to further the industrialization and progress of the state (Shapiro 2001). Suddenly, the thousands of years of 'harmonic' cultivation, modification, and utilization of the environment had come to represent a glorious past in which the people of China had been harnessing the productive might of nature and turning it to their own purposes.

Many times, Mao's aggressive approach to land and resource management threw caution to the wind and ignored even the observable impacts his policies had on the environment; believing that man could control nature through science and technology (Shapiro 2001). The enactment and completion of massive public work projects, such as dams, was a way for the communist state to enact its control over both the environment and the populace. In the early years, the joint actions of the people rather than technological development, spearheaded China's struggle for modernization. By keeping both the peasantry and the military employed and mobilized, working on highly visible projects, the Chinese government exerted control and directive force over those individuals as well as the environment (Murphey 1967). These public work projects were portrayed as man's desperate battle against nature.

Development

This legacy of garnering governmental power and prestige though the construction of highly visible public works can be seen in the construction of the Three Gorges Dam. Construction on the project officially began on December 14, 1994 (Gleick 2009). It was lauded as a triumph of man over nature, which would protect over 50 million people from the frequently dangerous flooding that came with the seasonal monsoon rains (Beattie 2002; Xu et al. 2013). The Three Gorges Dam has been lauded for its its ability to produce an incredible amount of hydroelectric power. Most of China's electricity is powered by thermal power plants, which run on coal (Gleick 2009). In the years shortly after the dam became operational, between 2003 and 2010, the amount of hydroelectric power generated by the dam was comparative to 406.7 million tons of coal being fired (Xu et al. 2013). The amount of electrical power generated by the Three Gorges Dam is the equivalent of one-sixth of China's total electrical capacity (Morgan and Waretini 2013). While the monetary expenses for such an undertaking are staggering from a developmental standpoint, some estimates are as high as 60 billion dollars, it is the social, cultural, environmental, and ecological costs, rather than the economic ones that have many activists up in arms (Beattie 2002; Gleick 2009; Tan 2008; Xu et al. 2013).

Displacement

As of 2008, approximately 1.25 million people had been displaced as a result of the Three Gorges Project over a 16-year period; now that number is estimated to be over 1.3 million people (Xu et al. 2013). With the development of the Three Gorges reservoir, 1711 villages, 356 communes, 116 towns, and 20 cites were submerged under the rising waters of the reservoir (Jackson and Sleigh 2000; Tan 2008; Xu et al. 2013). Residents from three counties -Wanzhou,

Fengjie, and Yunyang- all within the Chongqing reservoir section were disproportionately affected (Xu et al. 2013). The process of resettlement of individuals from areas impacted by developments in the Three Gorges region has had implications on both the refugees and their host communities (Tan 2008). Economic uncertainty, separation, and social conflicts are some of the issues experienced by those who were resettled from the region around Three Gorges Dam (Jackson and Sleigh 2000).

The difficulties of incorporating such a large quantity of individuals, many of them destitute, into designated host localities is an ongoing issue that is only exacerbated by the ostracization of refugee populations by their host communities (Jackson and Sleigh 2000; Xu et al. 2013). This has been compounded by the development of disease, such as malaria and schistosomiasis, also known as snail fever, among many of the refugees as a result of their living conditions prior to relocation (Jackson and Sleigh 2000; Zhu 2008). Despite promises of compensation, land, and positions in their original trades for those who were resettled, it became clear that due to the environment's carrying capacity, they could not be resettled locally (Beattie 2002; Xu et al. 2013). The population of the Three Gorges area were resettled farther afield, with the farmland they were promised by the government being taken from the local population with whom they were expected to integrate (Gleick 2009). Caught in a flood of rising tensions, many resettled individuals felt as though they are left without any prospects in foreign locales. As a result, many of the refugees have attempted to return to the Yangtze region, but the 600-kilometer-long reservoir submerged roughly 34,000 hectares of agricultural land, leaving farmers without fields to work (Gleick 2009; Jackson and Sleigh 2000; Xu et al. 2013).

Degradation

With the completion of the Three Gorges Dam, the flow of sediment from the upper reaches of the Yangtze has been drastically diminished (Gleick 2009; Sun et al. 2012). The deposition of those sediments enriches farmland and local vegetation, which will have variable and adaptive responses to the reduction of these vital sediments over time (New and Xie 2008). The process of sedimentation also helps to maintain the fragile ecosystems in the lower Yangtze watershed and the East China Sea (Chen et al. 2010; Sun et al. 2012). The impact of these flow changes, of both sediment and water, can be seen in the relationship between the Yangtze River and Dongting Lake below the Three Gorges Dam (Sun et al. 2012). For the first time, sediments from the Yangtze are no longer being deposited in Dongting Lake. On the contrary, the sediments originally deposited in Lake Dongting are being siphoned downstream and back into the Yangtze due to changes in the Yangtze's flow (Chen et al. 2010; Gleick 2009; Sun et al. 2012). Recent and prolonged droughts in the area have been exacerbated by the changes in water flow and have therefore caused several major lakes in the region to be as low as 40% their traditional capacity (Sun et al. 2012).

These variations in water level have led to the development of stagnant, shallow pools that provide breeding grounds for the spread of various diseases due to the proliferation of parasites and their chosen hosts. In particular, the increased sedimentation and lowering water levels allows for the increased reproduction of snails such as the *oncomelania*, which can carry the parasitic flatworms that transmit schistosomiasis (Jackson and Sleigh 2000; Zhu 2008). Those same warm shallow water pockets also serve as prime breeding grounds for *plasmodium*

parasites, which when transmitted through a host, such as mosquitos, causes malaria (Miller et al. 1994). The risk of transmitting these parasites only increases so long as the negative impacts that the Three Gorges Dam has had on regional ecosystems continue to exist.

In opposition to the reduced sedimentation rate, the rate of erosion downstream from the dam has substantially increased (Chen et al. 2010). Xu et al. (2013) provided information on the erosion rate of the Yangtze, which totaled 108.8 million cubic meters over an eight-year period from October of 2002 to the same month in 2010. These embankment collapses and landslides have caused damage to businesses, homes, farmland, personal property, and resulted in the loss of human life (Gleick 2009; Wang et al. 2004; Xu et al. 2013). One example of this was the Qianjiangping landslide, which occurred on July 14, 2003, the day before the reservoir reached 135 meters in depth (Gleick 2009; Wang et al. 2004). Wang et al. (2004), states that 14 people lost their lives and 10 were listed as missing when 24 million cubic meters of rock and earth blocked the flow of the Qunggan River, a tributary to the Yangtze. While the final collapse was a result of the water level change, it was determined that the bank had been alarmingly weak prior to the rising water levels (Wang et al. 2004). Situations like this point to the dam having further unforeseen impacts on an already-fragile region (Gleick 2009; Xu et al. 2013).

As discussed above, the changes in water flow rates and duration have had an impact on the sedimentation and erosion of the banks and channels of the Yangtze (Sun et al. 2012; Wang et al. 2004). These changes have impacted the topographic make-up of the region, but the sheer weight of the nearly forty million cubic meters of water being held back by the flood gates of the Three Gorges Dam has had another impact: an increase in seismic activity (Gleick 2009; Institution of Civil Engineers 1981; Li et al. 2005; Xu et al. 2013). Although there has been a significant increase in the number of seismic events in the region, the quakes in the immediate vicinity of the Dam have not exceeded a five on the Richter scale, which measures the strength of earthquakes (Gleick 2009; Xu et al. 2013) This falls in line with the anticipated outcomes laid out in the initial 1992 environmental impact statement produced for the project, and is still within a level that the structure of the dam can withstand (Li et al. 2005; Xu et al. 2013). However, as time goes on, the increased strain constantly placed on the Earth's crust in the areas now inundated by the reservoir, seismic events could exceed initial estimates, not only in frequency, but in magnitude.

Rapid acceleration in the deposition of nutrients and other materials from industrial waste, agricultural runoff, and seismic activity along the Yangtze, coupled with decreasing water flow rates has resulted in eutrophic conditions and algae blooms in the region (Gleick 2009; Li et al. 2014; Paerl et al. 2011; Xu et al. 2013). The pollution of the reservoir is not just limited to industrial and agricultural runoff; according to Gleick (2009), the city of Chongqing dumps an average of nearly one billion tons of untreated wastewater into the reservoir each year. Water quality and potability is a primary concern for those inhabitants who were not displaced by the formation of the reservoir (Paerl et al. 2011; Xu et al. 2013). Eutrophication has occurred in Xiangxi River, a major tributary to the Yangtze, and other major bodies of water in the region such as Lake Taihu near the Yangtze River Delta (Li et al. 2014; Paerl et al. 2011; Xu et al. 2013). These adverse conditions pose risks not only to the region's human inhabitants, but to local flora and fauna as well.

The Yangtze is home to 350 fish species, accounting for 36% of all freshwater fish species in China. As such, represents a crucial area for fish habitat and overall biodiversity (Gleick 2009; Park et al. 2003). The Three Gorges Dam is detrimental to the freshwater ecosystems of the upper and lower Yangtze because it prevents anadromous fish from reaching their spawning grounds and, in turn, prevents them from returning to the sea (Park et al. 2003). By altering the main channel of the Yangtze River, the Three Gorges Dam is the cause of habitat loss for endangered fresh water aquatic species like the Chinese Dolphin and Yangtze Sturgeon (Park et al. 2003; Sun et al. 2012). Not only endangered local fish, but also migratory bird populations rely heavily on the ecosystems of the lakes and wetlands of the Yangtze Basin to survive and reproduce (Gleick 2009; New and Xie 2008; Park et al. 2003; Sun et al.2012; Xu et al. 2013).

Conclusion

Although many of the potential long-term impacts of the Three Gorges Dam are unknown, they will likely unfold over the coming decades (Chen et al. 2010; Gleick 2009; Xu et al. 2013). Attention to the impacts that the dam has on the natural environment should be coupled with further scientific investigations throughout the coming years to ensure that any developing issues can be swiftly identified, and their impacts mitigated whenever possible. Particular attention should be paid to the impact the Three Gorges Dam has had on the quality of life for local inhabitants and dangers presented to wildlife in the region such as endangered aquatic and wetland species in the Yangtze River Watershed (Park et al. 2003; Sun et al. 2012; Xu et al. 2013). As the impacts of the Three Gorges project on fragile local and regional environments have not been fully realized, the identification of developing issues is of paramount importance. The increasing concern over human rights violations related to the relocation and the well-being of the inhabitants who were not relocated need to be addressed.

While the impacts of the Three Gorges Dam will continue to be felt for years to come, it offers information on how to adjust other projects, which are still in their planning stages or have not yet been put onto paper. By improving our understanding of the impacts that large development projects like Three Gorges have on their local and regional environments, we can adapt other projects to account for some of these issues (Xu et al. 2013). For example, the initial environmental impact statement for Three Gorges Dam did not account for individuals who lived on islands within the region the reservoir impounded and as a result their anticipated expenditure and resettlement calculations were inaccurate (Xu et al. 2013). More thorough investigation of the local demographics, settlement patterns, and overall biodiversity are crucial to the development of not only adequate, but accurate environmental impact assessments. As Beattie (2002) reminds us, if development project managers and government officials provide assurances of a peaceful and happy life, free of poverty, then they should have the foresight and scientific backing to support those claims before breaking ground on a project of such magnitude.

References Cited

Beattie, James
2002 Dam Building, Dissent, and Development: The Emergence of the Three Gorges Project. *New Zealand Journal of Asian Studies* 4:138-158.

Chen, Zhongyuan, Zhanghua Wang, Brian Finlayson, Jing Chen, and Daowei Yin
2010 Implications of Flow Control by the Three Gorges Dam on Sediment and Channel Dynamics of the Middle Yangtze (Changjiang) River, China. *Geology* 38:1043–1046.

Edmonds, Richard L.
1991 The Sanxia (Three Gorges) Project: The Environmental Argument Surrounding China's Super Dam. *Global Ecology and Biogeography Letters* 1:105-125.

Gleick, Peter H.
2009 Three Gorges Dam Project, Yangtze River, China. In *The World's Water 2008-2009: The Biennial Report on Freshwater Resources*, edited by Peter H. Gleick, pp.139-150. Island Press, Washington, District of Columbia.

Institution of Civil Engineers [ICE].
1981 Dams and Earthquake. *Proceedings of a Conference at the Institution of Civil Engineers*, Thomas Telford Ltd, London.

Jackson, Sukhan, and Adrian Sleigh
2000 Resettlement for China's Three Gorges Dam: Socio-economic Impact and Institutional Tensions. *Communist and Post-Communist Studies* 33:223–241.

Li Hong-Mei, Hong-Jie Tang, Xiao-Yong Shi, Chuan-Song Zhang, and Xiu-Lin Wang
2014 Increased Nutrient Loads from the Changjiang (Yangtze) River Have Led to Increased Harmful Algal Blooms. *Harmful Algae* 39:92-101.

Li Qiusheng., Li Zhengnong., Li Guiqing., Meng J.F., and Jie Tang
2005 Experimental and Numerical Seismic Investigations of the Three Gorges Dam. *Engineering Structures* 27:501–513.

Marks, Robert B.
2012a *China: Its Environment and History*. The Rowman and Littlefield, Lanham, Maryland.

Marks, Robert B.
2012b Chinese Communists and The Environment. In *Radicalism, Revolution and Reform in Modern China*, edited by Lynch, C., Marks, R. B., and Pickowicz, P. G., pp.105-132. The Rowman and Littlefield, Lanham, Maryland.

Marx, Karl and Friedrich Engles
1888 [1848] Manifesto of the Communist Party. In *Marx/Engels Selected Works, Vol. One.* Translated by Moore Samuel and Freidrich Engles, pp. 98-137. Progress Publishers, Moscow.

Miller Louis H., Michael F. Good, and Genevieve Milon
1994 Malaria Pathogenesis, *Science* 264:1878-1883.

Morgan, Kepa, and Amaria F. Waretini
2013 The Yangtze River: Hydro Development, Changing Geography, Cultural and Environmental Implications. In *Yangtze River*. Edited by Tracy B. Maloney, Boyce R. Hutchins. Nova Science, Hauppauge, New York.

Murphey, Rhoads
1967 Man and Nature in China. *Modern Asian Studies,* 1:313-333.

New, Thomas and Zongqiang Xie
2008 Impacts of Large Dams on Riparian Vegetation: Applying Global Experience to the Case of China's Three Gorges Dam. *Biodiversity and Conservation, 17,* 3149–3163.

Normile, Dennis
1997 Yangtze Seen as Earliest Rice Site, *Science, New Series* 275:309.

Paerl, Hans W., Hai Xu, Mark J. McCarthy, Guangwei Zhu, Boqiang Qin, Yiping Li, and Wayne S. Gardner
2011 Controlling Harmful Cyanobacterial Blooms in a Hyper-eutrophic Lake (Lake Taihu, China): The Need for a Dual Nutrient Management Strategy. *Water Research* 45:1973 - 1983.

Park, Young S., Jianbo Chang, Sovan Lek, Wenxuan Cao, and Sebastien Brosse
2003 Conservation Strategies for Endemic Fish Species Threatened by the Three Gorges Dam. *Conservation Biology* 17:1748–1758.

Shapiro, Judith
2001 *Mao's War Against Nature: Politics and the Environment in Revolutionary China*. Cambridge University Press, New York.

Sun, Zhandong, Qun Huang, Christian Opp, Thomas Hennig, and Ulf Marold
2012 Impacts and Implications of Major Changes Caused by the Three Gorges Dam in the Middle Reaches of the Yangtze River, China. *Water Resources Management* 26:3367–3378.

Tan, Yan
2008 *Resettlement in the Three Gorges Project*. Hong Kong University Press, Hong Kong.

Wang, F. Zhang, Y., Huo, Z., Matsumoto, T., and Huang B.
2004 The July 14, 2003 Qianjiangping Landslide, Three Gorges Reservoir, China. *Landslides* 1:157–162.

Xu, Xibao, Yan Tan, and Guishan Yang,
2013 Environmental Impact Assessments of the Three Gorges Project in China: Issues and Interventions, *Earth-Science Reviews* 124:115-125.

Zhu, Huai-Min, Shou Xiang, Kun Yang, Xiao-Hua Wu, and Xiao-Nong Zhou
2008 Three Gorges Dam and Its Impact on the Potential Transmission of Schistosomiasis in Regions Along the Yangtze River. *EcoHe*